As a member of the Consultive Committee for International Telegraph and Telephone (CCITT), AT&T's cooperation with other national telephone administrations is enabling some customers to dial selected overseas numbers for the first time on a limited basis.

Overseas Dialing: Yesterday, Today, and Tomorrow

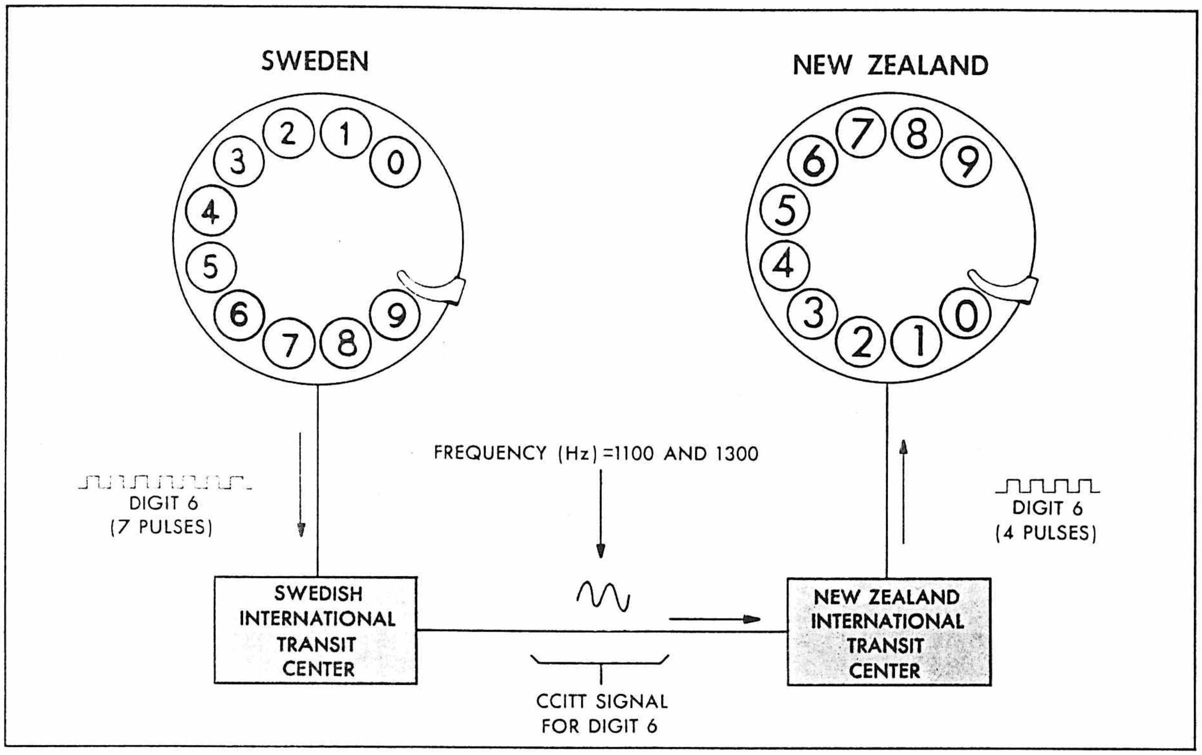
L. J. Scott

IT ALL STARTED ABOUT ninety-four years ago at the Centennial Exposition in Philadelphia—Alexander Graham Bell had gone there to demonstrate the telephone. Bell convinced Dom Pedro, the Emperor of Brazil, that the invention might have merit and the Emperor agreed to place a call across the convention hall to Sir William Thomson of England. The experiment was a success and a somewhat startled Dom Pedro turned to Mr. Bell and said, "You have made an invention that will change the way people live all over the world." The call spanned only a convention hall, but one might regard this as the beginning of international cooperation in telephone communications, which is a prerequisite for overseas dialing.

Telephony made rapid progress in those early days, but advances took place primarily within nations. Not much thought was given to interconnecting all the various national telephone systems of the world, primarily because the technology for spanning continents and oceans was not available. Even if it had been, the possible volume of overseas traffic would have been far too low to have merited serious consideration of overseas dialing.

Today all this has changed, and worldwide communication has entered a new and dynamic phase. The surge in overseas telephone communications is not at all surprising when one recalls the brief history of transoceanic communication. In fact, only a little over a century ago all communication across the ocean was by sailing ship.

With the first successful transatlantic cable, laid in 1866, however, a semblance of high-speed communication was provided, but for telegraph only. Not until 1927, when the first commercial radiotelephone service was inaugurated between New York and London, could people talk to one another across the Atlantic. Even then the performance of the radio circuits was subject to the vagaries of nature, and left much to be desired.


SWEDEN
NEW ZEALAND
1
2
3
4
5
6
7
8
9
0
DIGIT 6
(7 PULSES)
FREQUENCY (Hz) =1100 AND 1300
DIGIT 6
(4 PULSES)
SWEDISH INTERNATIONAL TRANSIT CENTER
NEW ZEALAND INTERNATIONAL TRANSIT CENTER
CCITT SIGNAL FOR DIGIT 6

While differences exist in the dial faces of various countries, these differences can be overcome by having international offices make the correct conversion. For example, if within the proposed International Direct Distance Dialing (IDDD) *system a Swedish customer dialed the number 6 (in calling New Zealand), 7 pulses would be sent to the Swedish international office, where they would be converted into the* CCITT *signal for 6. Upon receiving this information, the New Zealand international office would then convert this signal to 4 pulses, corresponding to the 6 on the New Zealand dial. Switching procedures among countries are complex, but the key behind the* IDDD *system is in worldwide agreement on ways and means of implementing customer dialing between various nations.*

Nearly three decades later, in 1956, and after years of experimentation and development, overseas telephony entered a significant new era with the opening of the first transatlantic repeatered telephone cable (TAT-1). Then, for the first time, reasonably adequate numbers of transatlantic telephone circuits became available, with transmission quality equal to that of the best landline circuits. The effect on usage was immediate and spectacular. In one year traffic to England nearly doubled. Additional underseas cables followed in rapid succession, with increases of 30 to 50 percent in traffic accompanying the cutover of each new cable. It is interesting to note that when people found it easier to talk, they also talked longer.

The tremendous increase in overseas messages gave rise to serious consideration of operator dialing. It became apparent that an efficient arrangement allowing overseas calls to be dialed, employing modern facilities and methods, would permit important savings and service improvements over existing methods, and would pave the way for the introduction of customer overseas dialing. Previous to this, an operator would have to contact her overseas counterpart to place the call. But with this method, the operator could dial the desired number directly.

There are places where international customer dialing has been in use for some time (for example, between the United States and Canada); overseas points such as Bermuda, Hawaii, Jamaica, and Puerto Rico can also be dialed directly by any long-distance operator in the United States. This is possible, however, only because these places follow our domestic plan for direct distance dialing, and employ compatible equipment and operating practices. Intercontinental customer dialing, on the other hand, differs substantially with regard to technical plans, and has presented a number of problems having unique international aspects. Not least of these is the language problem—both human and machine.

Switching machines, just like people all over the world, communicate in various "languages." For example, there are some five different machine languages employed in North America today to transmit "address," or information about the number being called. Still other "languages" are used to convey control and call status information (supervisory signals); included in this category are such things as requests for service, answer, and disconnect.

These differences, also common in other countries, are not confined to the switching systems, but extend all the way to the dial on the customer's telephone set. Difficulties are fairly obvious. In the United States we use a dial with 24 Roman letters. We would have trouble trying to dial an exchange identified by Russian Cyrillic letters or Chinese characters. Note also that the letter "O" corresponds to the numeral six on our dial while in England and France it corresponds to the digit zero. The French use the letter Q and have placed it in the zero position. The letters J and W are missing on the Danish dial. On the other hand, some dials have no letters at all. The dials in Sweden and New Zealand present an interesting contrast. In Sweden, the ten dialing holes are numbered 0 to 9 in a counterclockwise direction; the New Zealand dial, in contrast, is just the opposite. Dialing the digit 4, for example, on our dial generates four pulses, on the Swedish dial five pulses, and on the New Zealand dial six pulses.

When our national network links up with an international network, at what is called a Transit Center, switching machines in these centers must speak a universal language. To get international agreement on things such as this, negotiations were carried on directly with other administrations, and were facilitated by our participation in the work of the International Telegraph and Telephone Consultative Committee, the CCITT. The initials are really French, if initials can be said to have a nationality, and stand for Comite Consultatif International Telegraphique et Telephonique. The CCITT is a branch of the International Telecommunication Union (ITU), which is the U.N.'s specialized agency for telecommunications.

The introduction of Direct Distance Dialing (DDD) in our domestic network involved the formulation and implementation of a routing and a numbering plan. The initial phase was limited to operator dialing, while solving the complexities involved in customer dialing followed later. The introduction of International Direct Distance Dialing (IDDD) is following much the same pattern, and has required resolution of the same two fundamental problems, only this time not for just a domestic network but on a world-wide basis.

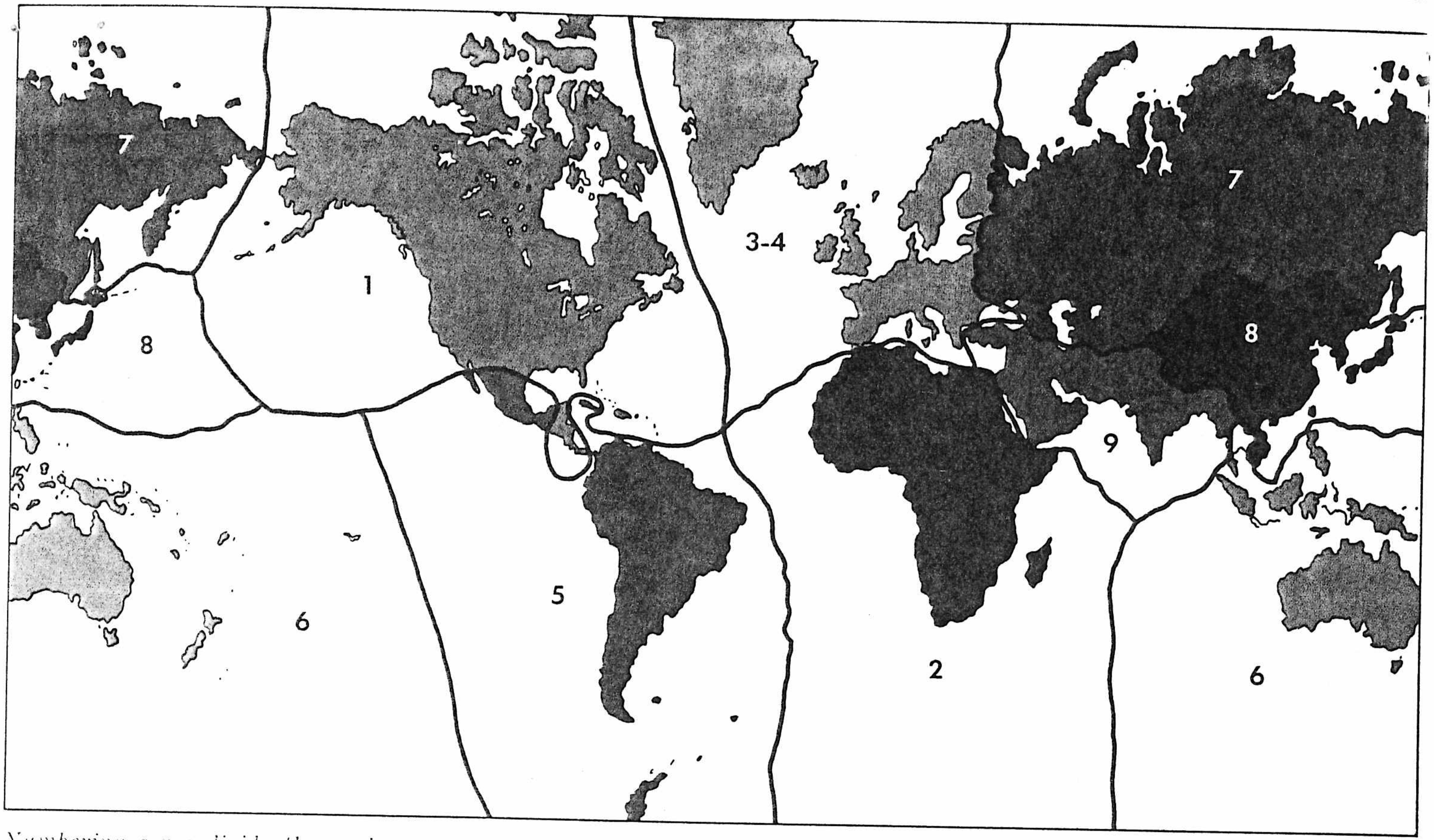
To tackle the problem of assigning a discrete number to each telephone throughout the world, members of the CCITT first estimated the number of telephones that would be in use in the various parts of the world by the year 2000. A set of eight geographic zones, called world numbering zones, was then established in an attempt to place these telephones in groups of comparable size, while at the same time recognizing certain natural geographic or political associations.

Code numbers were then assigned to the various countries within each zone, similar to the way that the United States and Canada are divided into Numbering Plan Areas (NPA's). An attempt was made to achieve a uniform 11-digit international number by assigning single-digit country codes to countries requiring 10 digits in their national number, 2-digit codes to those with 9-digit national numbers, and 3-digit codes to countries with 8-digit national numbers. Although this effort was not entirely successful, the majority of the world's telephones will be identified by an 11-digit international number, and the remainder by numbers varying in length from a minimum of seven digits to a maximum of twelve.

The country code always begins with the digit identifying the world numbering zone of the particular country to which the call is to be placed. Note that in our case the United States uses the North American code (zone digit "1") that covers the United States, Canada, most of Central America, and various Caribbean Islands, except Cuba. Only one other single-digit code has been assigned, namely, code "7" applying to all of Russia. All other countries have been assigned either two- or three-digit codes.

In formulating the routing plan, it was recognized that overall economy and a consistently high grade of service were of utmost importance. It is now generally accepted that a system of high-usage circuit groups, plus final circuit groups, will handle traffic much more efficiently than single, direct groups. Therefore, a system whereby traffic could overflow to final routes, from direct or high-usage groups, was considered essential if the World Routing Plan were to operate economically.

Operator dialing of overseas calls began in 1963 between the United States, England, France, and the Federal Republic of West Germany, using a new signaling system designed specifically for this purpose by representatives of the Bell System and the British, French, and German telephone administrations. This system, after some modification,



Numbering zones divide the various areas of the world into telephone groups of roughly comparable size, while at the same time recognizing certain natural geographical or political associations. While the country codes may consist of one, two, or three digits, they always begin with the digit identifying the numbering zone within which the particular country is located.

was subsequently approved by the CCITT as CCITT Signaling System No. 5 (see *"Signaling Systems . . . An International Concern,"* RECORD, *January 1970*), and is currently being used for operator dialing between the Bell System and 23 countries. This equipment serves as an "interpreter," which permits compatible operation between normally incompatible national networks and switching systems at each end of the international link. It is located at Transit Centers that serve as the switching medium through which our national network can be interconnected with overseas facilities.

At the moment, four such Transit Centers are located in the United States: White Plains, New York; New York City, New York; Jacksonville, Florida; and Oakland, California. All employ No. 4 type toll crossbar (4-wire) switching machines and handle domestic as well as overseas traffic. A fifth overseas operating center is planned for Pittsburgh, Pennsylvania, later this year, and a sixth for Denver, Colorado, is scheduled for the latter part of 1972.

The continued increase in the number of high-quality cable circuits (and more recently, satellite circuits), coupled with the trend toward decreasing toll rates, has resulted in a dramatic, almost explosive increase in overseas messages in the last few years. Unless new methods were found and implemented to handle this growth, new overseas operating centers of about 300 switchboard positions would be required roughly every 18 months. Naturally, attention turned to having customers dial overseas calls.

A limited trial of IDDD was conducted in 1967. Approximately 70 customers, all heavy users of overseas service, were served by a selected No. 5 crossbar central office in New York City, and were permitted to dial calls directly to London or Paris. The trial, which included customer dialing of both station-to-station and special calls, ran for about four months and was considered extremely successful. Pretrial apprehensions concerning possible customer confusion upon hearing foreign language recorded announcements or unfamiliar ringing, busy, or overflow tones appeared to be unfounded. A target date of 1970 was established for the start of commercial service.

Plans were then formulated to permit the introduction of customer overseas dialing in two phases. The initial phase was devised to provide limited service as early as practical with minimum modifications to the domestic network. At the same time, a primary objective was to permit easy transition to the long range plan, which envisioned customer dialing of all overseas calls to any dialable destination from any area where a reasonable volume of overseas traffic originated.

The introduction of customer dialing requires that the international number, which consists of the country code plus the national number, be preceded by a prefix or access code. The reason for this, of course, is to alert the switching machines to the fact that the digits following the prefix represent an overseas call, and that the initial digits should be translated as a country code rather than an area or office code in our own domestic network. The international prefix is determined by the country of origin. The U.S. system uses two prefixes: 011 for station-to-station calls, and 01 for person-to-person and special calls, such as collect, credit card, etc., requiring operator assistance. The code 010 has also been reserved for possible use in reaching an overseas assistance operator.

The initial plan for commercial customer-dialed service is limited to non-coin, station-to-station calls, for which the number is known. This service will be available initially only to customers served by selected No. 5 crossbar offices equipped for Automatic Message Accounting (AMA).

Because of the variable number of digits in international numbers, the originating local office has to determine when dialing is complete. Two arrangements have been made available. On all calls, critical timing of 3 to 5 seconds is started after the seventh and each subsequent digit; if no further digits are received prior to timeout, dialing is assumed to be complete. Customers with 12-button TOUCH-TONE® sets may use the twelfth button (#) as an "end of dialing" signal to cancel timing and permit the call to be processed immediately. Also, since the No. 5 crossbar originating registers are limited to a maximum of eleven digits (not counting the prefix digits), initial service will be confined to countries having eleven digits or less in their international telephone numbers.

In looking towards the long-range IDDD plan, which would require a maximum of twelve digits, it seemed highly desirable to avoid modifying all toll switching machines merely to increase their digit capacity. This problem was solved by having the machine use a two-stage out-pulsing scheme upon receiving the international telephone number as dialed by the customer.

The first stage of outpulsing consists of sending an internally generated 3-digit system code of the 0XX or 1XX variety, which all toll machines can handle. The local office translates the first three digits of the international number, which determines the Transit Center to which the call should be routed. The call is then sent link by link, using the appropriate 3-digit system code, through the domestic network to the selected Transit Center. Here the call is switched to a so-called "loop around trunk" to obtain access to an overseas sender. When a sender has been attached, an electrical proceed-to-send signal (as well as an audible tone) is returned to the originating No. 5 crossbar office.

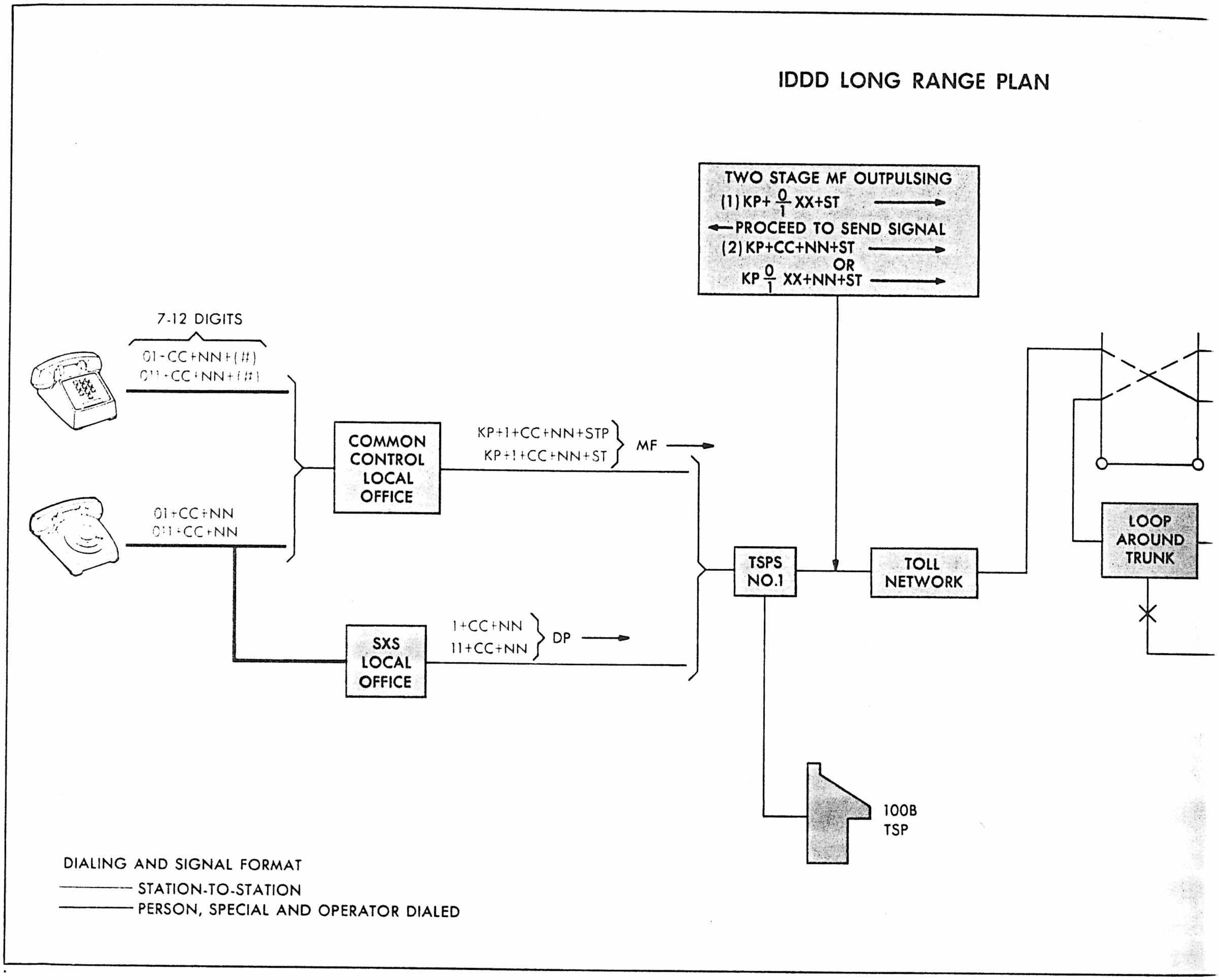
The second stage of outpulsing then takes place, whereby the complete international number is transmitted over the switched connection from the originating office directly to the overseas sender in the international Transit Center. The call is then sent forward in the same manner as if it had been initiated by an operator at an overseas operating center, with the following exception. If an operator places a call that could require intervention by an operator at an overseas location, a language digit in the address format establishes the language to be spoken by the operator—in our case, the English language digit "2." This digit is stored in the trunk circuit at the terminating Transit Center; if assistance is required, our overseas operator sends a "Forward Transfer" signal, which causes an English speaking operator to be connected.

On the other hand, customer dialed, non-coin, station-to-station calls are not eligible for operator intervention; in this case the discriminating digit "0" is inserted instead of the language digit. The discriminating digit, in addition to marking the call as ineligible for operator intervention, can initiate screening logic at the terminating Transit Center so that customers will be prevented from reaching unauthorized points.

Since operators and customers are not required to dial the language or discriminating digit, this is inserted by switching logic immediately following the country code on transit calls, or immediately in front of the national number on terminal calls. (Since a terminal call involves only one additional international link, the country code is not required for further switching and is deleted at the outgoing Transit Center.)

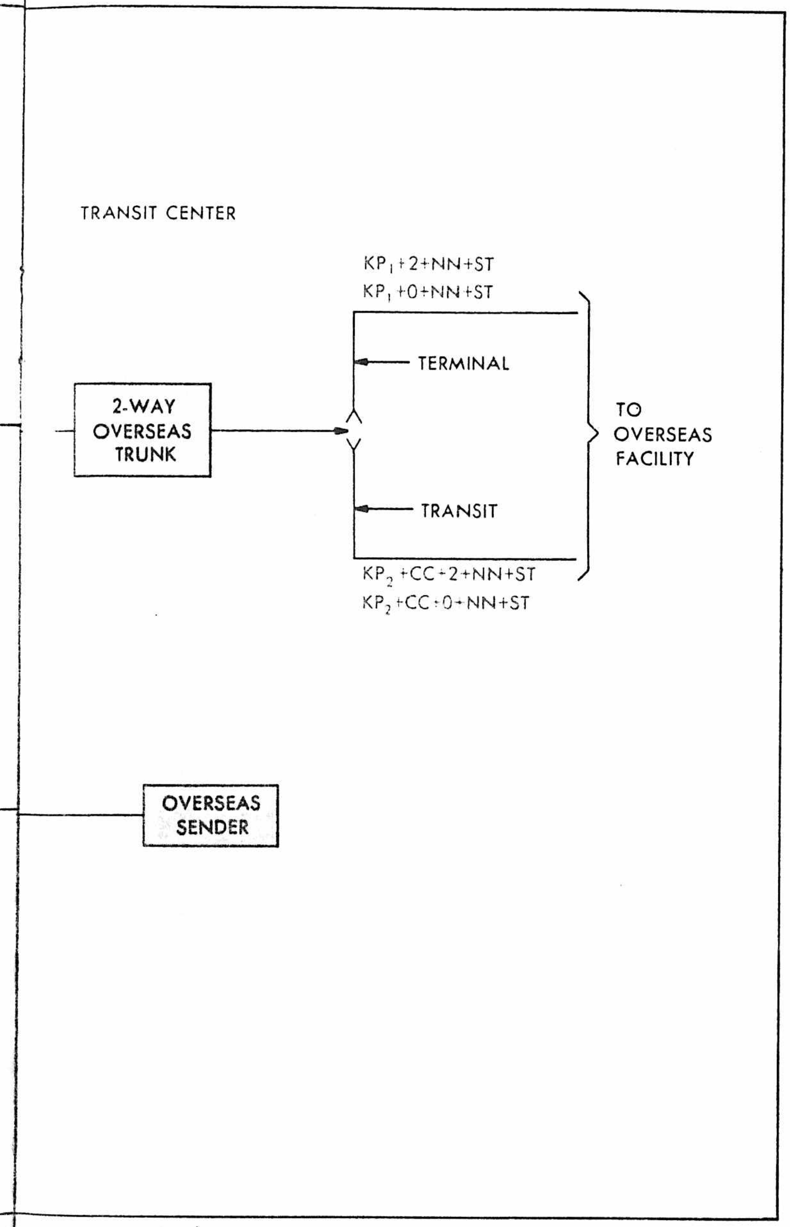
Commercial service from London to New York City started on March 1, 1970. Service to the United Kingdom started March 15, 1970, for the roughly 24,000 customers served by three No. 5 crossbar offices in mid-Manhattan. Extension of this service is anticipated by the end of 1970.

The two-stage outpulsing required for the IDDD plan, in conjunction with the audible proceed-to-send signal, will permit overseas calls to be originated by an originating toll center operator having MF (multifrequency) key pulsing. This is



In the long-range IDDD *(International Direct Distance Dialing) plan, local common-control offices delete the international access code (01 or 011) and prefix the digit 1 as an overseas indicator. If the call is one that involves operator assistance,* TSPS *No. 1 deletes the standard country code (CC) and substitutes an arbitrary three digit code (0XX or 1XX). The overseas Transit Center deletes this arbitrary code, substitutes the standard country code, if the call does not terminate at the next Transit Center, and inserts the English language digit 2, immediately preceding the national number (NN). With customer dialed station-to-*

referred to as International Originating Toll Center (IOTC) operation. A trial of the IOTC operation was held at the East 37th Street operating center in New York City, in September, 1969, and was considered very successful. More than half of the calls handled were completed on a non-hangup basis, with a substantial reduction in operating effort and call setup time (as compared to present procedures that employ both local originating and overseas operators). It is expected that IOTC operation will find wide application in the United States, and, in combination with IDDD, should keep the work load on overseas operating centers at a manageable level.



station calls, the discriminating digit 0 is inserted instead of the anguage digit. The entire address is prefixed by a special key pulse signal (KP 1 or KP 2) to indicate terminal or transit sta tus, respectively. These digit manipulations are required to control switching logic as the call progresses through the network.

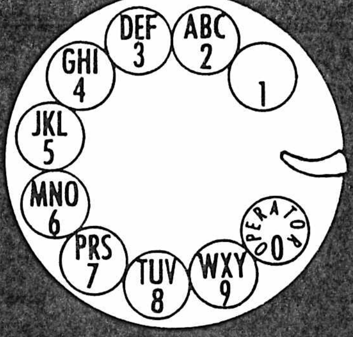
The long range plan for IDDD is a logical extension of the initial plan, and will include customer dialing of special calls, such as person-to-person calls, credit card calls, and coin calls, which require operator assistance. This service will be applicable in any area having Traffic Service Position System (TSPS) No. 1. Since such functions as digit analysis, route translation, AMA recording, and two-stage outpulsing will be provided by the TSPS, this plan will substantially reduce the cost of modifying local offices to provide IDDD service.

Customer dialing procedures will be the same as in the initial plan except that customers may also dial special calls using the 2-digit prefix "01" and can dial calls having 12-digit addresses. Outpulsing to TSPS from local common control offices, will be on an MF basis and will include an initial digit "1" as an overseas identifier; a special start pulse will identify calls requiring operator assistance. In the case of a non-common control SXS (step-by-step) office, the initial "0" of the prefix code will cause the call to be routed to TSPS where all subsequent dial pulse digits will be registered; special calls and station calls will be identified by the initial "1" or "11."

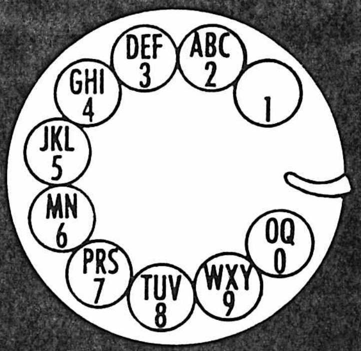
Two-stage outpulsing will be employed by TSPS No. 1 similar to that used by the local offices in the initial plan, with one exception. When a customer dials a non-coin, station-to-station call (not eligible for operator intervention), the Transit Center must insert the discriminating digit "0" preceding the national number; on customer dialed calls requiring operator assistance or on calls dialed by the operator, the English language digit "2" must be inserted instead. Therefore, the Transit Center must somehow make this logical decision. This is done by assigning each dialable country code a separate and distinct 3-digit code of the 0XX or 1XX type to identify calls requiring the insertion of a language digit. The conversion, when required, from the standard country code as dialed by the customer or operator to the arbitrary 3-digit code, is performed automatically by stored logic in TSPS No. 1.

When viewed from overseas, the North American network has a precise 11 digit format (the digit "1" for the North American zone plus the 10 digits of the NPA + 7 digit local number). Other countries, with equipment that can adapt to varying lengths of destination addresses, have been able to provide outward IDDD at about the same time, but from a greater number of originating central offices. The United Kingdom originated inward DDD to New York City, March 1, 1970, with about 2000 messages daily. Germany and Belgium originated inward service from selected cities to all parts of the United States, March 15th. Also, a limited trial from a few customers in Paris has been in effect for some months.

International dialing is still in its infancy, but all indications are that it will mature rapidly. When this occurs, in the not too distant future, customers will literally have the world at their fingertips.



UNITED STATES



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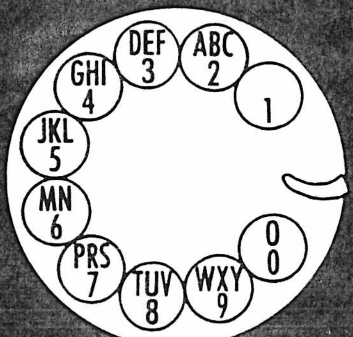

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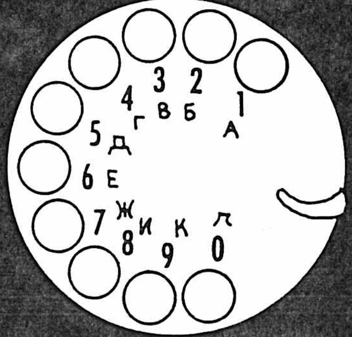

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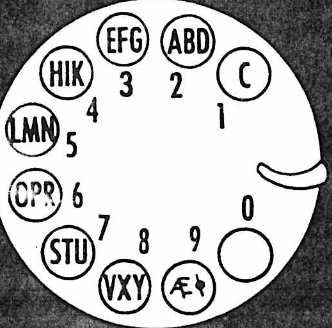

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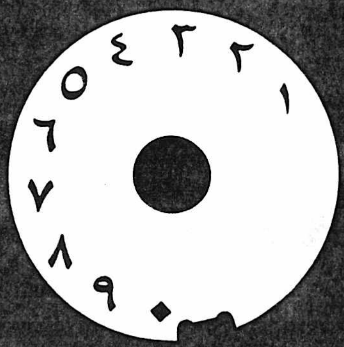
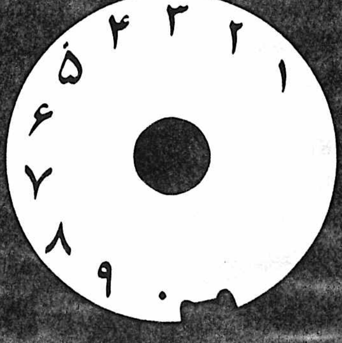
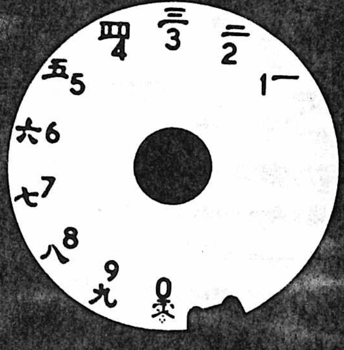


ARABIA



IRAN



CHINA